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GB 2245372 A

GB 2225867 A

GB 2158953 A

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INT CL<sup>5</sup> G01R 11/24, G07F

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(54) Detecting tampering in commodity supply meters.

(57) In a pre-payment type electricity meter with means to detect tampering, a watchdog circuit 2 monitors the operation of a microprocessor 4 which records the supply of electricity to the consumer and should the tampering produce "crashing" in the microprocessor, the watchdog circuit co-operates with other circuitry (6-20) to open a switch 22 to cut the power supply to the consumer.

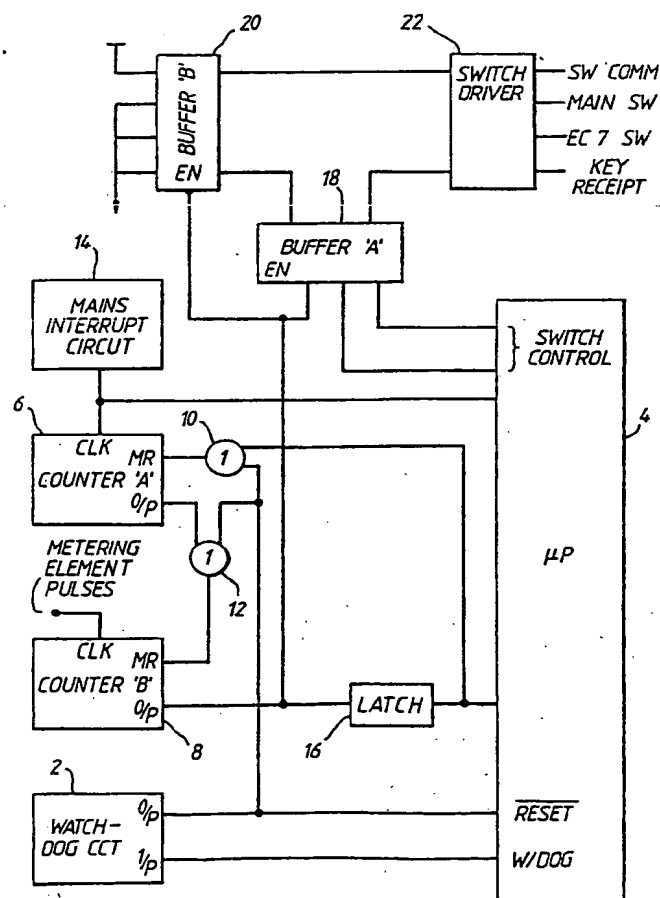


Fig.1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

1/2

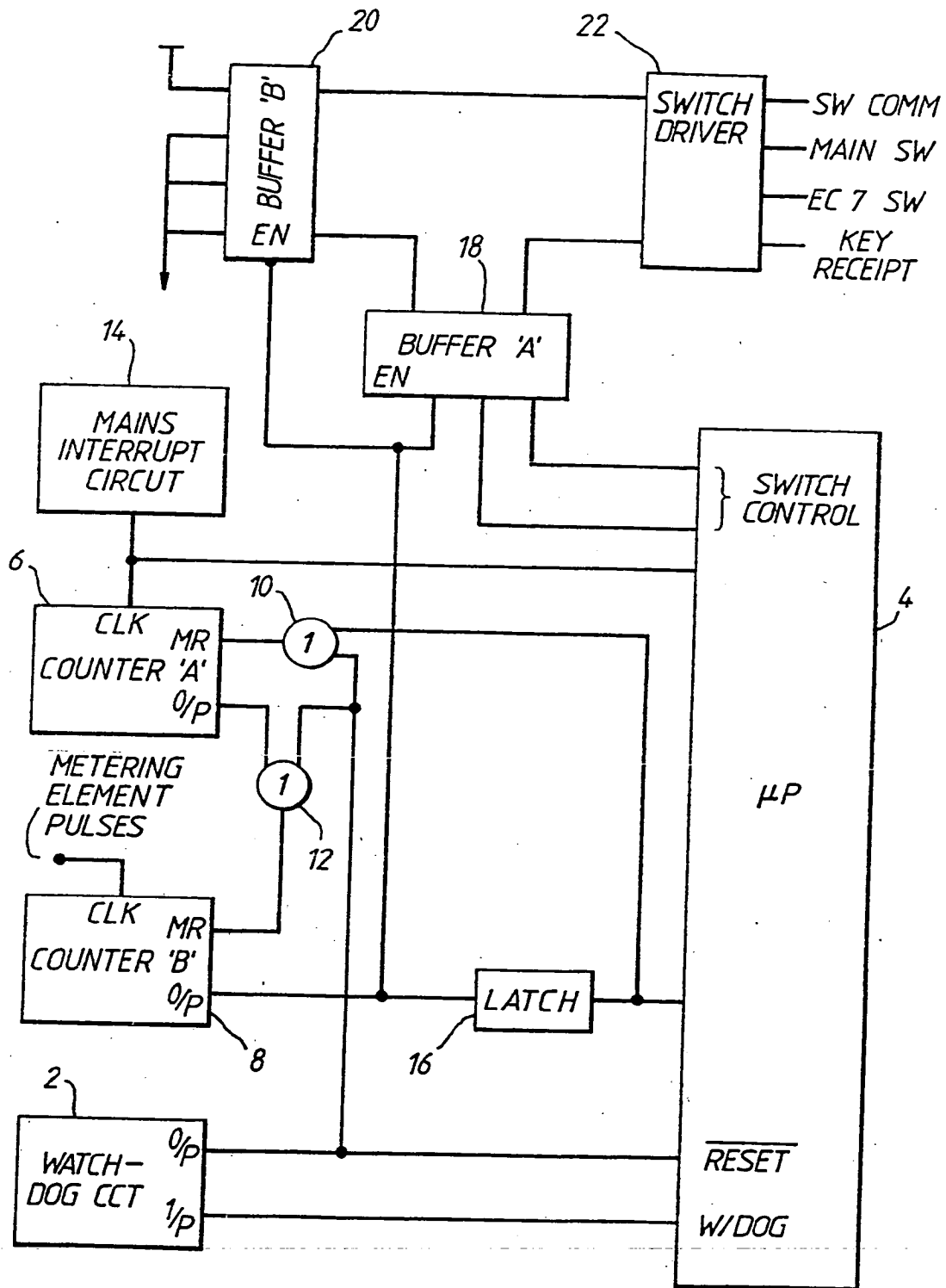


Fig.1

2/2

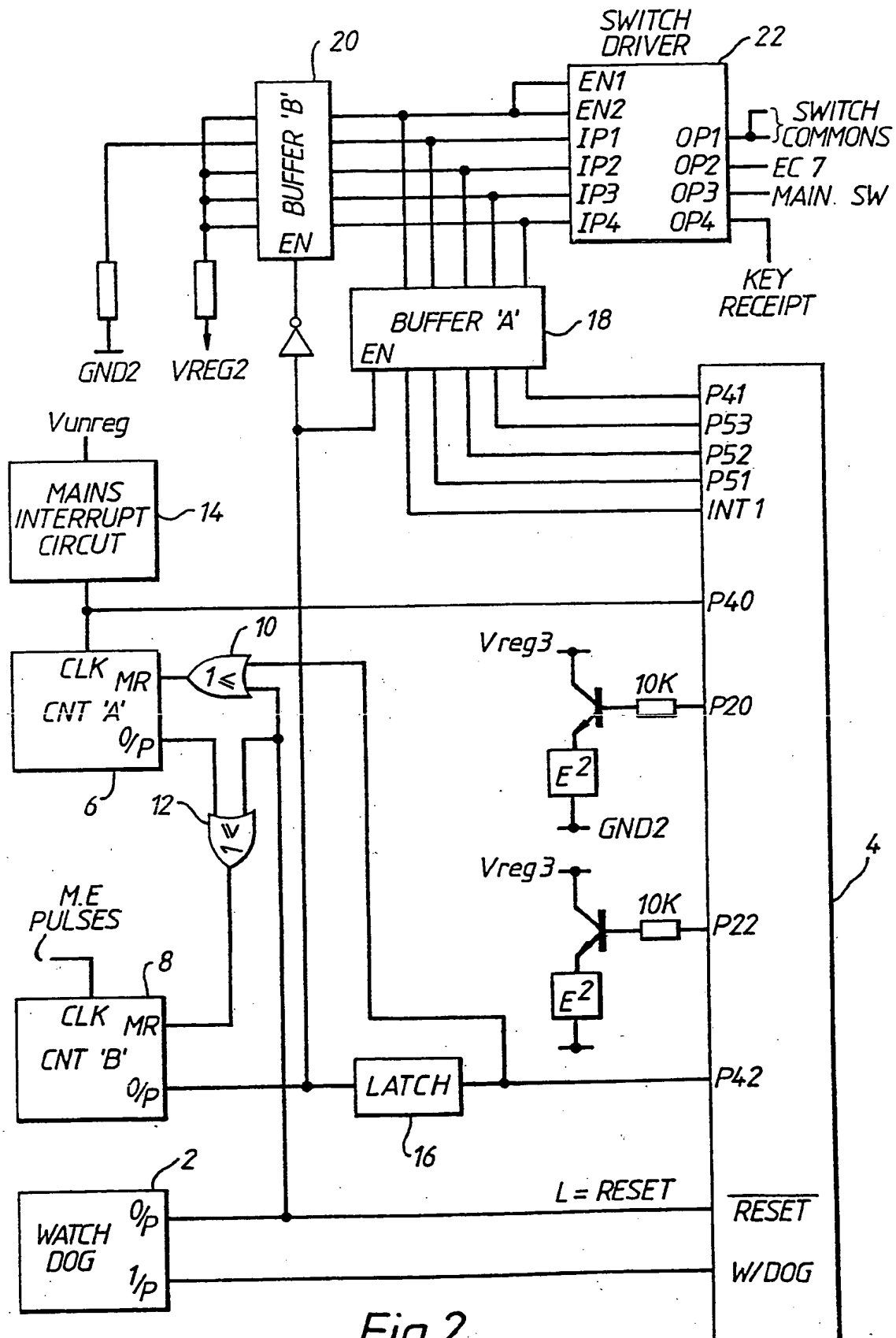


Fig.2

IMPROVEMENTS IN OR RELATING TO COMMODITY SUPPLY  
METERS

This invention relates to commodity supply meters and more especially, but not exclusively, it relates to electricity supply meters.

Credit meters and pre-payment meters requiring the insertion of coins or tokens by the user are well known and unfortunately, are not uncommonly the subject of fraud.

The present invention has for an object to address the problem of meter fraud.

Fraud attempts may take many different forms but they generally involve tampering with the meter so that the product is thereafter supplied without payment or with a smaller payment than would normally be required.

According to one aspect of the present invention, a meter for recording the quantity of a product supplied to a consumer comprises at least one re-settable switch for interrupting the supply of the product via the meter and tamper detection means responsive to fraud attempts for operating the switch to interrupt product supply, the switch being adapted and arranged to be re-set only by authorised persons.

According to another aspect of the invention, the meter may include a recording device operable when tampering is detected by the tamper detector for recording details appertaining to any tampering detected.

In one particular kind of meter a key or token is used to initiate the supply of electricity. Such meters embody a microprocessor which facilitate recordal of the quantity of

electricity used. One kind of fraud which is especially envisaged is tampering to effect "crashing" of the microprocessor. In order to prevent this kind of fraud succeeding, a watchdog circuit may be used which serves to monitor the condition of the microprocessor via a watchdog output terminal. Whenever the watchdog output is stuck high, or low, or changes frequency, the watchdog circuit is arranged to issue a re-set pulse to the processor and additionally to condition two counters.

An embodiment of the present invention will now be described with reference to the accompanying drawings, in which;

FIGURE 1 shows a block diagram of part of a commodity meter, and

FIGURE 2 shows a further block diagram of the commodity meter shown in Figure 1, including power supply connections and other connections in greater detail.

The following description should be read in conjunction with Figures 1 and 2, wherein like element blocks have been given the same numerical designation.

A watchdog circuit 2 is arranged to monitor the input signal for a change of state. If this change of state does not occur within a certain period of time, for example, one second, then the circuit will activate its output signal on output line O/P. The watchdog circuit may contain simple timing circuits to provide a high degree of immunity from external interference. The input signal on line I/P for the watchdog circuit is generated by the microprocessor 4. The microprocessor 4 will provide, during normal operation, a stimulus required for the watchdog to maintain its inactive state. If the microprocessor 4 fails to maintain this task, possibly because of loss of control, then the watchdog circuit 2 will trigger

and provide a reset signal on its output line O/P which should return the microprocessor 4 to normal operation. At the same time, the counter A,6 and counter B,8 are set to a known state via logic gates 10, 12. The counter B,8 is arranged to receive metering element pulses at its clock input.

The mains interrupt circuit 14 receives the unregulated mains supply, although any regular source of impulses could be used to drive this device. The mains interrupt circuit 14 provides regular impulses which are used to provide accurate timing functions for the counter A,6 and the microprocessor 4. The counter A,6 comprises a chain of digital circuits which count the input pulses from the mains interrupt circuit 14. The counter A,6 is normally inhibited by the action of the watchdog circuit 2, or the latch circuit 16. If the counter A,6 fails to be inhibited by either the watchdog circuit 2 or the latch circuit 16, then the counter A,6 will produce an output after a certain predefined period which may be one hour.

The counter B,8 comprises a ripple counter which may provide an output after eight pulses from the metering element. This output is normally inhibited by the action of counter A,6 or the latch circuit 16. If the counter B,8 is allowed to reach a value of eight, then it will activate the latch circuit 16 and take control of the switch control which comprises buffer A,18, buffer B,20 and a switch driver 22.

The latch circuit 16 comprises a single bit memory element, the function of which is to remember the occurrence of eight or more impulses within one hour, whilst the microprocessor 4 was unable process them. The activation of the latch circuit 16, causes the switches to adopt a fix known state, normally the switches will

be held in an open state. When the latch circuit 16 is activated, the buffer A,18 is disabled and the buffer B,20 is enabled. Also when the latch circuit 16 has been set, it may only be reset by external means. It will be seen from the drawings that the switch driver 22 operates switches to disconnect the utilities found in a domestic supply such as for example the Economy 7 supply and the main supply.

The commodity meter may also include a suitable recording device to record all attempts of tampering.

The circuit arrangement described above, accommodates the following system failures.

1. The microprocessor 4 crashes with the switches closed and < 8 metering enable pulses / hour.  
In this case, nothing would happen, the microprocessor 4 will have re-set and taken control.
2. The microprocessor 4 crashes with the switches closed and > 8 metering enable pulses / hour.  
In this case, the output from counter B,20 will set the mains switch driver to open the switches and sets the latch circuit 16 to record the event when the microprocessor 4 recovers.
3. The microprocessor 4 held in re-set with the switches closed, < 8 metering enable pulses / hour.  
In this case nothing will happen as the power consumption is very low.
4. The microprocessor held in re-set with the switches closed, > 8 metering enable pulses / hour.  
In this case the output from counter B,20 will set the mains switch driver to open the switches and sets the

latch circuit 16 to record the event when the microprocessor 4 recovers.

5. The microprocessor crashes with the mains switch open and therefore no metering enable pulses are present.

In this case nothing will happen as no power is being consumed.

It will readily be appreciated by those skilled in the art, that the present invention may be improved within the spirit and scope of the present invention, for example, it is possible to switch power onto electrically erasable, programmable random only memories, only when such devices are required for use.

## CLAIMS

1. A meter for recording a quantity of a product supply to a consumer, comprises at least one re-settable switch for interrupting the supply of the product via the meter and tamper detection means responsive to fraud attempts for operating the switch to interrupt product supply, the switch being adapted and arranged to be reset only by authorised persons.
2. A meter as claimed in claim 1, wherein the tamper detection means includes a watchdog circuit, arranged to monitor the performance of a microprocessor, which is arranged to monitor the supply of the product, and to initiate a reset signal for the microprocessor when the watchdog circuit determines that the microprocessor has functioned incorrectly.
3. A meter as claimed in claim 2, wherein the tamper detection means further includes a first counter and a latch circuit, the first counter is arranged to count a number of input pulses and is normally inhibited by the watchdog circuit or the latch circuit and is arranged to generate an output signal after a predetermined time period when the first counter is not inhibited by the watchdog circuit or the latch circuit.
4. A meter as claimed in claim 3, wherein the tamper detection means includes a second counter arranged to receive metering element pulses and generate an output signal after a predetermined number of pulses has been counted, said second counter is arranged to be inhibited by said first counter or by said

latch circuit, and when said second counter is permitted to reach its predetermined count it causes the latch circuit to be activated to take control of switch control circuitry.

5. A meter as claimed in claim 4, wherein activation of the latch circuit causes the switches to be set to a known state.
6. A meter as claimed in claim 4 or claim 5, wherein the switch control circuitry includes a first buffer arranged to control a switch driver and a second buffer arranged to control the switch driver, when said first buffer is inhibited.
7. A meter as claimed in any preceding claim, wherein a recording device is operable for recording details of any tampering detected by said tampering detection means.
8. A meter substantially as hereinbefore described with reference to Figures 1 and 2 of the accompanying drawings.

- 8 -

**Patents Act 1977**  
**Examiner's report to the Comptroller under**  
**Section 17 (The Search Report)**

Application number

GB 9310201.0

**Relevant Technical fields**

(i) UK Cl (Edition L ) G1N; G1U; UR1124; G4V

(ii) Int Cl (Edition 5 ) G01R 11/24; G07F

Search Examiner

K F J NEAL

**Databases (see over)**

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI

Date of Search

16 JULY 1993

Documents considered relevant following a search in respect of claims 1-8

| Category<br>(see over) | Identity of document and relevant passages             | Relevant to<br>claim(s) |
|------------------------|--|-------------------------|
| X                      | GB 2245372 A (AMPY) See abstract, Figure 1,<br>Claim 2 | 1, 7                    |
| X                      | GB 2225867 A (MUTCH) See abstract and<br>Figure 4      | 1, 7                    |
| X                      | GB 2158953 A (GEC) See abstract and<br>Figure 1        | 1                       |

| Category | Identity of document and relevant passages | Relevant to claim(s) |
|----------|--|----------------------|
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